

**PROJECT REPORT
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FOR THE ARMED FORCES
CHICAGO ILLINOIS

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REPORT NO. 1

FILE NO.
M-908

CONTRACT NO.
11-009-qm-70305

PERIOD COVERED
January-August, 1947

INITIATION DATE
1 January 1947

TITLE: [X] PROGRESS REPORT [] PHASE REPORT [] ANNUAL REPORT [] TERMINATION REPORT

Significance of Salmonella Types

SUMMARY

Food of animal origin has occupied an important place in balancing rations supplied our armed forces. Obviously, it was of prime importance to protect the health of troops by such rigid inspection service as it was practicable to conduct. Food poisoning outbreaks, while kept at a significantly low level, were not entirely eliminated. One aspect of this work in relation to the public health concerned vigorous investigations of Salmonellosis outbreaks in man. Painstaking efforts were directed toward elucidation of these outbreaks. It cannot be denied, however, if one carefully examines many of the published reports, that the evidence is sometimes questionable in implicating one or another food as the source of the infection. Food and food products, particularly meats, eggs and egg products have been found to harbor many Salmonella types, implying their possible role in Salmonella outbreaks in man. Now that so many types have been identified from various foods it becomes exceedingly important to investigate the alleged pathogenicity of these particular strains for man. Two approaches toward solution of the problem are apparent. One is to test directly the affect of the alleged pathogens on human volunteers; the other is quite basic in nature, requiring more knowledge of the organisms through a close inspection and study of their organic constituents which might shed some light as to the pathogenic significance of these organisms in comparison to well established human pathogens. Toward the latter, we have directed our attention.

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Improved methods of isolation and accurate technique for antigenic analysis of *Salmonella* organisms have led to the classification of a single genus of microorganisms which is distinctive for no other genus of bacteria. So unique is this classification that currently more than 180 *Salmonella* types have been characterized. Judging by the rapidity with which new *Salmonella* types are being reported, one is tempted to look upon the existence of multiplicity of species with some suspicion. This fact alone suggests that basic organic chemical changes are being experienced by these *Salmonella* organisms, implying instability of antigenic elements. Particularly does it appear to be true for the flagellar antigenic components. Evidence has been accumulating, chiefly as a result of the work of Edwards and his associates, which points rather emphatically to the unstable nature of flagellar antigens.

Natural or induced transformations have never been reported for the *Salmonella* group. While modifications have been described for this genus in certain isolated instances, they are not equivalent to the transformations of pneumococcal types or that of the "Berry" phenomenon for certain viruses. The changes which have been observed are for the most part so-called "loss variations". Thus, for example, it is possible through artificially exhausting the d antigen of *S. salinatis* IV, XII; d,e,h - d,e,n,z₁₅ to transform the latter to a species indistinguishable from that of *S. sandiego* IV, (V), XII; e,h - e,n,z₁₅. Similar reports of "loss variants" may also be found. Perhaps the nearest approach to transmutation may be found in the recent report of Bruner and Edwards (1), in which are described a number of antigenic changes produced in vitro, involving the growth of *Salmonella* types in the presence of homologous agglutinating antisera. One change concerns *S. thompson* VI, VII; k - 1,5 which was transformed into a culture serologically identical with *S. cardiff* VI, VII; k - 1,10 by growth in serum for phase 1 (k) and single factor 5. Thus are the unstable properties of flagellar constituents strongly confirmed. The latter fact strengthened by known duplications of somatic antigens among many *Salmonella* types has justified the proposal of a plan for testing the possibility of artificially inducing predictable, type-specific modifications.

In order to test the probability of inducing changes among *Salmonella* species, two cultures were specifically selected. The cultures included *S. pullorum* IX, XII; __, and *S. montevideo* VI, VII, g,m,s, - __. It was reasoned that if through some method or methods the living organisms of the non-motile *S. pullorum* could be induced to acquire the flagellar constituents of *S. montevideo* the resulting bacilli might possibly resemble *S. enteritidis* I, IX, XII; g,m - __ in many of its antigenic constituents. Therefore, serial cultures were made of *S. pullorum* in a broth medium containing inactivated homologous antiserum. A suspension of *S. montevideo* cells was

heated at 63°C for seven minutes. The two cultures, with appropriate controls, were inoculated into a series of mice. S. enteritidis was isolated from 64.3 per cent of the experimental animals. However, the results strongly favored the possibility of the mice harboring this species of *Salmonella* prior to the inoculations.

It was advisable to repeat this experiment. The work to date indicates that, under the conditions attempted, it has not been possible to induce cultures of S. pullorum to acquire antigenic elements from other *Salmonella* types, namely, S. montevideo or E. typhosa. S. pullorum was isolated from seven of thirty-four mice inoculated with living cells of this species, a recovery of 20.6 per cent.

Efforts are being continued toward altering the antigens of S. pullorum into such competent organism which might undergo a modification in body character. In view of the evidence presented it is entirely reasonable to suppose that interconvertibility of *Salmonella* types is possible, even though the present attempt has failed.

Reference

- (1) Bruner, D. W., and Edwards, P. R. : Changes induced in non-specific antigens of *Salmonella*. J. Bact. 53: 359 (1947)